

RESEARCH ARTICLE

Determining the effects of blended learning using the community of inquiry on nursing students' learning gains in sudden patient deterioration module

Weichu Liu¹ | Jun Wang²  | Han Zhang³ | Changfeng Yu³ | Shuai Liu³ | Cen Zhang³ | Jingya Yu³ | Qiao Liu⁴ | Bing Yang⁵

¹Department of Gynecology, The First Affiliated Hospital of Chongqing Medical University, Chongqing, China

²Department of Nursing, The First Affiliated Hospital of Chongqing Medical University, Chongqing, China

³School of Nursing, Chongqing Medical University, Chongqing, China

⁴Department of Pediatric Dentistry, Stomatological Hospital of Chongqing Medical University, Chongqing, China

⁵Department of Nursing, Stomatological Hospital of Chongqing Medical University, Chongqing, China

Correspondence

Qiao Liu, Department of Pediatric Dentistry, Stomatological Hospital of Chongqing Medical University, Chongqing, China.
Email: 500232@hospital.cqmu.edu.cn

Bing Yang, School of Nursing, Chongqing Medical University, Chongqing, China.
Email: yangb@hospital.cqmu.edu.cn

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Abstract

Aims: To determine the effectiveness of blended learning using the community of inquiry framework on nursing students' learning gains in a sudden patient deterioration module.

Design: A quasi-experimental trial.

Methods: 233 Chinese nursing students in their fourth semester of a sudden patient deterioration learning module were assigned to control ($N = 113$) and experimental group ($N = 120$). Students in experimental group engaged in community of inquiry-based blended learning in sudden patient deterioration module, including computer-aided self-instruction, team-based topic discussion and simulation training. Control group learned similar contents through face-to-face teaching comprising of a presentation with lecture, tutorial and simulation training. Student assessment of learning gains, knowledge and practical ability was quantified after the interventions.

Results: Compared with control group, students in experimental group had improved student assessment of learning gains ($p = .001$, Cohen $d = 0.69$) and practical ability ($p < .001$, Cohen $d = 0.48$). Although no significant difference in overall knowledge score, experimental group students did better performance in application and analysis ($p = .001$, Cohen $d = 0.45$).

KEYWORDS

community of inquiry, learning gains, nursing, patient deterioration, teaching strategies

1 | INTRODUCTION

As defined in the current literature, a deteriorating patient "is one who moves from one clinical state to a worse clinical state which increases their individual risk of morbidity, including organ

dysfunction, protracted hospital stay, disability, or death." (Jones et al., 2013, pp. 1031–1032). It is important to emphasize the essential role of nursing students in recognizing the dynamic and changing nature of a patient's condition in addition to vital sign derangement and observations (Alshehry et al., 2020). Previous

Liu and Wang were equally contributed to this article.

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research has indicated that junior medical staff and students have significant shortfalls in recognizing and rescuing deteriorating patients on time, making this an important healthcare education issue (Leonard & Kyriacos, 2015; Redfern et al., 2019). Nurses are trained in initiating first-line treatment and emergency supports, although lack of knowledge/skills, practice reasoning and inefficient communication and teamwork (Hart et al., 2014; Jarvelainen et al., 2018; Purling & King, 2012). These might lead inexperienced nurses and undergraduate students to fail in grasping the global condition of a patient, failing to respond appropriately to acute events (Bogossian et al., 2014; Padilla & Mayo, 2018). Considering the suggestions of Liaw et al. (2016), to tackle the deficiency of one or several abilities of nursing students, a key question of undergraduate nursing education arises: How can we promote and integrate students' knowledge, skills, clinical reasoning and perception of teamwork for handling acute patient deterioration situations?

One option is developing teaching strategies designed for sudden patient deterioration (SPD) to deal with the theory-practice divide. A systematic review showed that blended teaching has been used in more than 90% of the related studies (Connell et al., 2016). One of the most common procedures is using strategies that incorporate classroom, skill laboratories and simulation training (Hart et al., 2014). A meta-analysis found that simulation-based interventions exert a positive effect on knowledge and performance (Orique & Phillips, 2018). However, it seems hard to foster communication, teamwork and clinical judgement skills (Jarvelainen et al., 2018). Furthermore, students were significantly more aroused in simulation training, and public pressure in the presence of other students during lectures might inhibit questions and raise fears of poor performances (Al-Ghareeb et al., 2019; Mills, Carter, et al., 2016). In addition, Bogossian et al. (2014) tested the performance of nursing students who completed the FIRST2ACT™, a high-fidelity simulated environment to develop and refine recognition and response skills. They found that less than 10% of students could reach the adequate threshold, showing an overall lack of pre-requisite knowledge, situation awareness and teamwork. As such, in addition to considering the integration of teaching platforms, it is of key importance to offer a suitable pedagogy, which underpins a learning environment to promote active learning, teamwork, knowledge integration, access to support and emotional responses.

The community of inquiry (Col) framework, proposed by Garrison et al., could provide the basis for creating a learner-centred environment for online education (Stenbom, 2018). It contains three core components: social, cognitive and teaching presence (Kim & Gurvitch, 2020). When engaging in online learning, social presence is the process of communicating in a trusting environment and project their personalities; cognitive presence is the process of construct and confirm meaning through sustained reflection and discourse, and teaching presence is the process of the design, facilitation, and direction of cognitive and social presence to realize personally meaningful and educationally worthwhile learning outcomes (Kim & Gurvitch, 2020). The Col framework is a

student-centred teaching model that assumes learning occurs within the community through the interaction of these three core elements (Stenbom, 2018). This adaptation could bring pedagogy and technology closer to learner needs at the tertiary level (Jackson et al., 2013; Shea & Bidjerano, 2009).

To our knowledge, the Col framework has shown potential contributions in learning satisfaction and higher-order learning. It was widely introduced into a series of disciplines, such as health sciences (Moser et al., 2015), business (Chen et al., 2017) and languages (Sun et al., 2017), while limited research related to online learning in nursing education (Smadi et al., 2019). A concern exists in that nursing programmes (e.g. SPD module) require advanced communication skills (Lewis, 2012), although the Col framework is currently mainly implemented in online environments, such distancing and virtual nature of the programme may hinder the development of these skills (Smadi et al., 2019). Another concern related to the online environment is that medical or nursing undergraduate education is mostly face-to-face or blended due to characteristics of the health sciences. Considering that the Col framework emphasizes interactive learning and communication, it has been noted that the creation of a learning community according to the Col framework in a blended learning format may address some of these concerns (AlKhaibary et al., 2021; Siah et al., 2021).

A search through the current literature identified a few studies involving the Col framework focused on educational programmes for nursing: (a) the use of Skype to support nursing students on international placement (Stephens & Hennefer, 2013) and (b) using a Col framework for nursing research subject and clinical skill-based module (Mills, Yates, et al., 2016; Siah et al., 2021). Both studies provide evidence that the Col framework enhanced communication and learning experience. However, these studies lack comparison with traditional teaching models and were not clear about the mechanisms of the combination of educational interventions and whether those interventions were effective on the cognitive level along with other possible learning outcomes.

Given the limited amount of previous research addressing Col and undergraduate nursing education, the potential of this framework to close the theory-practice gap should be investigated. Consequently, the aim of this study was (a) to create a learning community based on blended learning to supplement existing SPD management education and (b) compare the effectiveness of administering this programme with current teaching strategies (e.g. face-to-face teaching and simulation training) on self-reported learning gains, knowledge and practical ability concerning the recognition and response to deteriorating patients.

2 | METHODS

2.1 | Design

The research project used a two-group, quasi-experimental design. Ethical approval was given by the ethics committee of the first

author's university. Participants and study partners provided written informed consent.

2.2 | SDP module

The SPD modules are divided into two stages in the fourth and sixth semesters of the baccalaureate nursing programme curriculum in China. This study focused on the first stage. Participants had been taught relevant skills and knowledge prior to involving in this integrated module, including basic medical sciences (e.g. respiratory distress, shock, altered conscious state, fluids, electrolytes and acid-base balance), health assessment (e.g. measuring vital signs, electrocardiogram), fundamental care skills (e.g. oxygen therapy, administering medications, therapeutic communication) and literature evaluation skills. Time devoted to teaching the first stage of the SPD module is eight hours in the students' university, which was consistent with the median programme time reported by other studies (Connell et al., 2016). The SDP module was designed for undergraduates based on a review of the literature, specialized teaching groups and teaching platforms in our university. The teaching groups included four senior lecturers and four clinical nursing specialists in critical care. The learning content was composed of five sections (Jiang & Qian, 2018): (a) conceptions, (b) observation and assessment of deterioration, (c) nursing first-aid techniques, (d) emergency/deteriorated patient management and (e) emergency cases training which involves implementing teaching strategies and platforms: face-to-face teaching in classroom, web-based teaching platform (<http://e-learning.cqmu.edu.cn/meol/index.do>), simulation laboratory (Laerdal learning application system, Co.) and a virtual experiment platform (<https://www.cqmu.edu.cn/jyxx/syjxpt1.htm>).

2.3 | Participants

The participants were selected via convenience sampling from two second-year undergraduate classes at a four-year baccalaureate nursing programme in Chongqing between June–July 2019. These students were selected because (a) they were required to complete the SPD module in the semester according to the curriculum and (b) at no arrangement throughout their past curriculum had students been exposed to “high-fidelity” simulations. There were no exclusion criteria for this study. Of the 235 second-year (second semester) nursing students enrolled, 233 participated and were evaluated in this study. All participants received a researcher-designed SPD programme and were assigned to two teaching strategy groups. Students in the control group ($N = 113$) received face-to-face lectures, tutorial and simulation training. Col-based blended learning in the SPD module was conducted in the experimental group ($N = 120$). The power calculation was based on previous research (Wang et al., 2014) and analysed through Power Analysis and Sample Size Software (PASS vision 11). To achieve 80% of power to detect

a medium effect size of 0.5 with alpha 0.05 in primary outcomes for two-sample comparison of means, 168 participants were required to complete the trial. To allow for estimated attrition of 20%, 210 students were needed. A flow chart of the study is shown in Figure 1.

2.4 | Interventions

Experimental group engaged in Col-based blended learning of SPD module. Steps to create this approach as follows:

Step 1-Set up learning groups. Participants set up their own study groups (3–4 people per group) and online learning forums as a learning community. Students in the learning community were encouraged to free inquiries, and teachers and students interacted with each other in time.

Step 2-Learning the knowledge of SDP module. Self-directed online learning of SPD knowledge according to course goals (120 min); virtual skills study, including support breathing technology, basic life support technology, gastric lavage (60 min); Self-choosing two out of four virtual cases training through clinical thinking training system software (DxR NSCN-15/USA) (60 min).

Step 3-Face to face or online discussion (40 min).

Step 4-Skill practice as a group in a simulation laboratory (200 min).

Steps 1, 3 and 4 involved social presence and are aimed to provide a trusting environment to communicate and project personalities. Step 2 represents cognitive presence, aimed at facilitating learners' construction and validation of integrated knowledge through sustained reflection, combination and mental rehearsal. Steps 1, 2, 3 and 4 reflected teaching design: a student-centred learning pattern focused on self-learning, leadership and inter-professional team communication.

Control group received existing teaching methods (teacher-led method): (a) the learners in the control group attended face-to-face instruction in the SPD module. The theoretical knowledge was conducted by large lectures (120 min), cases and skills training by tutorials (160 min) in the laboratory. (b) The learning content was consistent with the experimental group. (c) Skill practice under the teacher's guidance in the simulation laboratory (200 min).

2.5 | Data collection and measurements

The questionnaire survey was conducted on the day of the end of the SDP course. Knowledge and skill performance were examined 7 days after the SDP course completion. To ensure the equivalent previous academic performance of students in control and experimental groups, a grade point average (GPA) of the student, a cumulative average of all compulsory courses' grades they gained, was collected before enrolment in this study. Faculty accessed students'

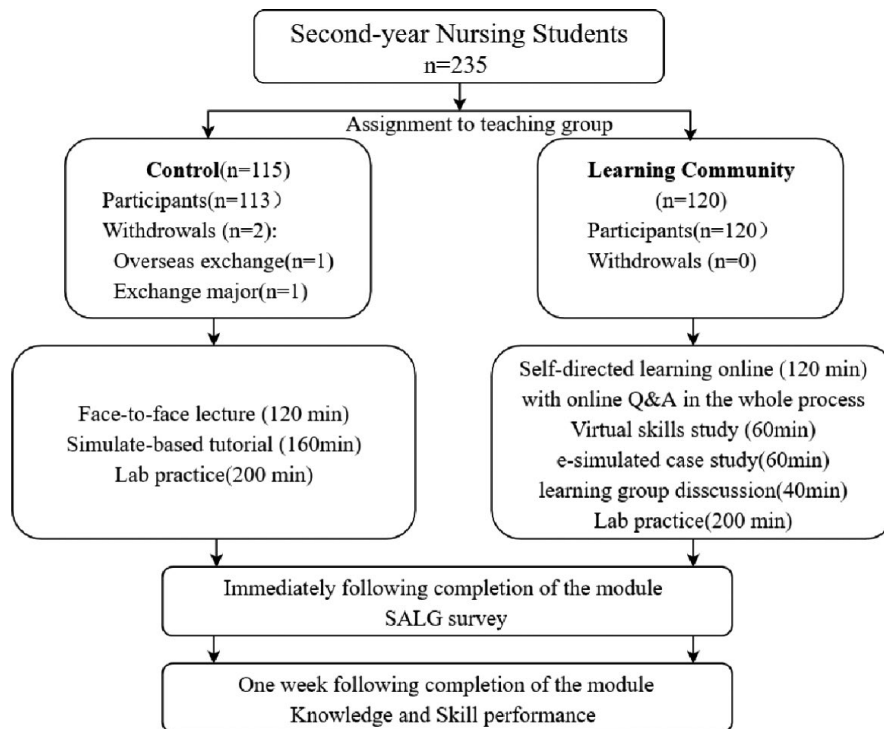


FIGURE 1 Flow chart of the study

GPA by intranet of the university. All responses were anonymous. Three instruments we used as follows.

2.5.1 | Perceived learning gains

The student assessment of learning gains (SALG) questionnaire-free online survey was used to explore students' perceived gains in cognition, skills, attitudes and the format of the inquiry-based community (Seymour et al., 2000). The reliability and validity of the SALG have been previously established (Frawley et al., 2019; Redmond et al., 2018). A generic template of the survey currently available on the SALG website (<https://salgsite.net/>) which can be customized to meet the needs of a specific learning module or course was adopted. SALG is divided into 10 sections with a series of closed questions (64 items) and open-text responses to questions about their comments in each section. Six sections focus on enablers of learning, including teaching & learning approaches, learning activities, assignments & assessment, educational resources, general information received and support given. The other four sections focus on learning gains containing developing understanding, generic skills acquired and attitudes changing, integration of learning. All items were self-reported by students based on the learning experience, ranging from 0 (no help/not at all) - 4 (excellent help/a great gain). The instrument was modified to meet the cultural setting and SPD learning objectives for a semester developed by our school. Five educationalists assessed the content validity of the questionnaire, and the content validity index was 0.90, which indicated all items were of vital importance and relevant with SALG. Internal consistency was assessed using Cronbach's alpha statistic which is considered to be a measure of

scale's reliability. The SALG had Cronbach's alpha of 0.971 in this study, which indicated great consistency (Zhou, 2018).

2.5.2 | SPD management knowledge

Students' knowledge about SPD management was measured by a set of test papers. The test paper's generation strategy was based on a bilateral table of a detailed catalog developed by four experts who were not directly involved in teaching, including two nursing professors and two clinical coaches. The 43 questions were extracted from the online question bank and examination evaluation system of the students' university. Among this test, memory and explanatory questions account for 51% and the rest questions were application ones. All students were required to complete the test within 120 min, and test papers were scored automatically by the system (on a scale of 0-100). The quality of the test paper was identified by the degree of difficulty and discrimination. The difficulty index was defined as the percentage of students who answered test papers correctly, ranging from 0-1, the smaller the value, the more difficult that test paper is (Koçdar et al., 2016). The difficulty index of this test paper is 0.63, an appropriate value of 0.30-0.70, which indicated that 63% of students could give the correct answers to the whole test paper. A discrimination index is the ability to differentiate between high and low scoring students, the higher the value, the better the ability to distinguish between high- and low-level students (Koçdar et al., 2016). The discrimination index of this test paper was 0.28, close to 0.30, which indicated an acceptable level. The internal consistency reliability coefficient was 0.76, above 0.70, showed results measured by this test paper were consistent and stable. All the above evaluation

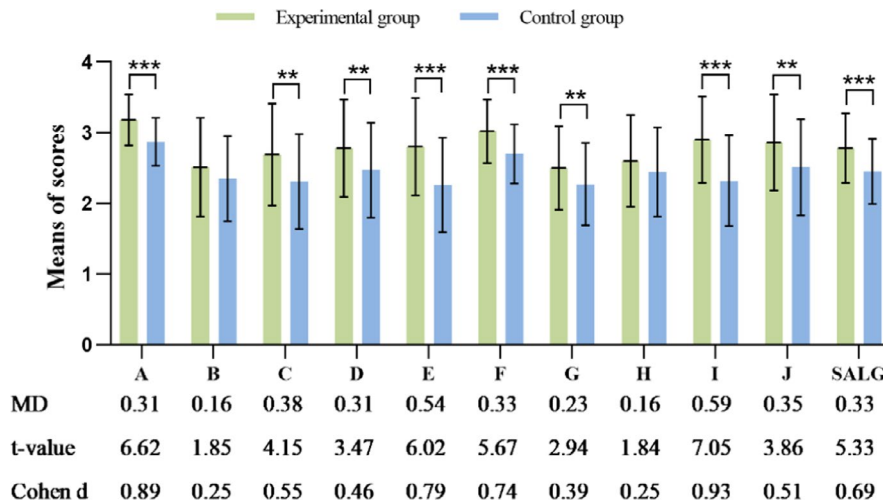


FIGURE 2 Comparison of the ten sections of SALG between two groups. A to J reporting: A. Developing understanding; B. generic skills acquired; C. changing attitudes; D. integration of your learning; E. teaching & learning approaches; F. learning activities; G. assignments & assessment; H. educational resources; I. general information received; J. support given. MD, mean difference, SALG, student assessment of learning gains. Notes: ** $p < .01$, *** $p < .001$; experimental group: $N = 116$ (four questionnaires were incomplete); control group: $N = 112$ (one questionnaire was incomplete)

indicators were automatically generated by the KAOYI network examination system (Xi et al., 2013).

2.5.3 | Practical ability

Competence in managing SPD was assessed through a nursing comprehensive experiment evaluation (NCEE) checklist. It was developed by the faculty of our university and widely used to assess nursing students' practical ability in clinical skill-based teaching (Wang et al., 2014). The NCEE checklist focused on evaluating students' clinical skill performance for patients' assessment and management in each scenario. The tool included four indicators and 21 items, a total score of 100. It contained experimental preparation (5 items, 20 points), case analysis (5 items, 25 points), skill performance (6 items, 35 points) and management efficiency (5 items, 20 points). A student group was asked to complete the same SPD case within 20 min including five minutes to familiarize with the case and prepare for equipment and supplies, 10 for simulation and role-playing and five more for explaining a diagnosis. The faculty gave marks according to their group performance. The examination occurred in a single loop corridor, avoiding disclosure of assessment information. Group grades were taken as individual scores. In this study, the NCEE checklist had acceptable reliability, with Cronbach's alpha of 0.701.

2.6 | Data analysis

Statistical analysis was performed with IBM SPSS v.23 (SPSS Inc.) with a significance level set at $p < .05$. A descriptive analysis of the variables was using rate, means and standard deviations (SD). Independent samples t test was conducted to determine differences in students' perceived learning gains, SPD management knowledge

and practical skills in the control and experimental groups. Cohen's d was used to measure the effect size of two independent samples, which was interpreted as small (0.2–0.5), medium (0.5–0.8) or large (0.8) (Cohen, 1988). A directed content analysis was used for narrative responses to the open-ended questions (Elo & Kyngäs, 2008). The coding and extraction topics were completed by two researchers. The purpose of the analysis was to seek commonalities or differences in students' comments. Qualitative comments offer supporting evidence and further meaning, background and explanation to supplement the statistical results.

3 | RESULTS

3.1 | Sample characteristics

Out of the 235 students (control group = 115, experimental group = 120) who consented to participate in the study, the mean age was 20.1 years (ranging from 19–21). None of the students had any previous nursing clinical practice. There was no statistically significant difference between the two groups for gender, age and prior courses GPA. Two students in the control group withdrew from the study because of overseas exchange ($N = 1$) and changing the major ($N = 1$).

3.2 | SALG in two groups

As shown in Figure 2, the mean total score of SALG was significantly higher in the Col-based blended learning group (mean = 2.78, $SD = 0.49$) compared with the control group (mean = 2.45, $SD = 0.46$). Specifically, there was significant difference for learning gains in two groups, in terms of developing understanding ($t = 6.62$,

$p < .001$, Cohen $d = 0.89$), attitudes changing ($t = 4.15$, $p < .001$, Cohen $d = 0.55$) and integration of learning ($t = 3.47$, $p = .001$, Cohen $d = 0.46$). Considering enablers of learning, scores for teaching & learning approaches ($t = 6.02$, $p < .001$, Cohen $d = 0.79$), learning activities ($t = 5.67$, $p < .001$, Cohen $d = 0.74$), assignments & assessments ($t = 6.17$, $p = .004$, Cohen $d = 0.39$), general information perceived ($t = 7.05$, $p < .001$, Cohen $d = 0.93$) and support given ($t = 3.86$, $p < .001$, Cohen $d = 0.51$) in the Col-based blended learning group were significantly greater than those of control group. Learning skills and educational resources were found no significant difference between two groups. Overall, compared with the control group, students involving Col-based blended learning reported greater gains and better experience.

Besides, open-ended comments in both Col-based blended learning and control groups reported some similar and positive experiences in each relevant section. For example, "Teaching objectives are clear" and "General information and learning support we received are helpful and satisfied", teachers were described as "amicable" "easy-going" and "with great clinical experience in SPD." Moreover, students in the Col-based blended learning group mentioned comments as follows:

- communication and collaboration development: "I felt comfortable interacting with my classmates and teachers through the online medium without disrupting the class and pressure from others"
- inter-personal relationships development: "I still felt a sense of belonging and trust while disagreeing with other team members"
- teaching quality and satisfaction: "Learning community method is creative and useful," "I am very actively involved and enjoy sharing with others," "It is invaluable and practical," and "I am not sure whether the learning and skills gained could effectively change to real practice in clinical environment."

3.3 | SPD management knowledge in two groups

As shown in Table 1, the total score of SPD theoretical test grade was a little bit higher in the Col-based blended learning group

(mean = 63.53, $SD = 7.30$) compared with the control group (mean = 62.75, $SD = 7.63$); however, the difference was no significant ($t = 0.79$, $p = .432$, Cohen $d = 0.10$). Interestingly, compared to the control group, the score of application and analysis level in the Col-based blended learning group was higher ($t = 3.42$, $p = .001$, Cohen $d = 0.45$), while no significant difference was shown in the level of knowledge and understanding between the two groups.

3.4 | Practical ability in two groups

The total score of practical ability in the Col-based blended learning group was 64.48 ($SD = 7.44$), while that in the control group was 60.53 ($SD = 9.06$), and the difference was statistically significant between two groups ($t = 3.64$, $p < .001$, Cohen $d = 0.53$). Moreover, in terms of skill performance ($t = 4.05$, $p < .001$, Cohen $d = 0.54$) and management efficiency ($t = 4.10$, $p < .001$, Cohen $d = 0.48$) were reported significant differences for the two teaching strategies as well (see Table 2).

4 | DISCUSSION

Sudden patient deterioration is one of the most important learning contents for nursing undergraduates, which requires them to cooperate to deal with deteriorating patients. In this study, we designed and determined the effectiveness of Col-based blended teaching strategies in the SPD module for nursing students. Our results demonstrated that the Col-based blended learning approach is effective in perceiving greater learning gains and enablers of learning and projecting better practical ability for nursing students. However, there was no significant improvement in the mastery of theoretical knowledge of SPD. As such, our researcher-designed blended learning community for nursing students could contribute to more benefits of the learning experience and clinical performance in the SPD learning module.

To our knowledge, it is the first time to conduct a blended learning community based on the Col framework and use the SALG instrument to measure students' learning gains in the SPD nursing education. The findings indicated that nursing students who participated in Col-based blended learning reported greater gains and

TABLE 1 Comparison of SPD management knowledge between two groups

Levels of cognition ^a	Experimental group N = 120	Control group N = 113	MD	t	p	Cohen d
	Mean (SD)	Mean (SD)				
Knowledge and understanding	28.41(3.92)	29.20(3.57)	+0.78	1.58	.115	-0.21
Application and analysis	35.78(4.8)	33.58(5.07)	-2.21	3.42	.001	0.45
Total scores	63.53(7.35)	62.75(7.63)	-0.77	0.79	.432	0.10

Abbreviations: LC, learning community; MD, mean difference.

^aCognitive levels are based on a modified version of Bloom's taxonomy (Bloom et al., 1956).

TABLE 2 Comparison of practical skills of SPD management measured by NCEE checklist between two groups

Indicators ^a	Experimental group N = 120	Control group N = 113	MD	t	p	Cohen d
	Mean (SD)	Mean (SD)				
Experimental preparation	13.90(2.44)	13.66(2.30)	-0.24	0.76	.447	0.10
Case analysis	16.50(2.28)	16.40(3.12)	-0.10	0.29	.776	0.04
Skill performance	22.68(3.22)	20.88(3.55)	-1.79	4.05	<.001	0.53
Management efficiency	11.00(4.12)	8.95(3.47)	-2.05	4.10	<.001	0.54
Total scores	64.48(7.44)	60.53(9.06)	-3.95	3.64	<.001	0.48

Abbreviations: MD, mean difference, NCEE, nursing comprehensive experiment evaluation.

^aFour indicators of NCEE checklist.

better experience compared with the control group overall. The experimental group carried out communication on a network platform and simulation training in groups, which could promote communication and collaboration between students. The finding was consistent with the study conducted in simulated disaster drill experience (Digregorio et al., 2019). Students in the control group were being taught in a big class they might find the prospect of asking a question in the presence of sizeable other participants was too daunting (Mills, Carter, et al., 2016). Besides, the team members were free to brainstorm online or in-person with a discussion focused on relevant issues, which creates a trusting, active and non-judgemental learning environment. This teaching strategy is in line with the principle of participation (engagement and interaction), students reported it helped in developing inter-personal relationships, consistent with similar research (Ryan & Poole, 2019; Tofade et al., 2013). Moreover, study groups of 3 or 4 people set were contributed to collaboration improvement in simulation training of SPD (Deinzer et al., 2019; Mills, Carter, et al., 2016). Wilson et al., (2009) found that a pre-assigned learning team consisted of mostly females with a narrow age got higher collective team scores and reported having "support," "friendship." Their findings exactly corroborate with the characteristics of our students (eighty-five per cent of them were female and they were between 19–22 years old). In brief, these findings further support the conception that promoting individual expression and early participation in teamwork indeed operationalize the social presence (Arbaugh et al., 2008).

In addition, this study also analysed the impact of Col-based blended learning strategies on the specific dimensions of SALG. Compared with traditional teaching strategy, perceived learning gains of students' case discussion, the frequency of course activity and simulation training in the experimental group showed improvement. As the previous study reported, the Col framework was effective in stimulating both inquiry and thorough comprehension (Mills, Yates, et al., 2016). However, students' perceived gains in skills were no significant promotion compared with the control group. Some comments like uncertain and a less confident response to skill development section also illustrated this. This shows that designing flexible and tailored courses are a challenge. A systematic review pointed out that blended learning for clinical skills teaching

in nursing education is needed further exploration (McCutcheon et al., 2015). Regarding enablers of this SPD learning, students in the Col-based blended learning group perceived more support such as peer support and general information received during the interaction, which increases students' participation (Howe et al., 2017). Moreover, teaching & learning approaches, learning activities, assignments & assessments in experimental group teaching strategy played vital roles in facilitating in-depth SPD learning. On the one hand, this illustrates that Col-based blended learning is effective for stimulating SPD learning. On the other hand, no doubt that these perceived stimulative factors in the process of SPD learning would provide ideas for improving course design.

The results of total score of SPD knowledge comparison between the two groups demonstrated that Col-based blended learning did not result in a significant improvement in knowledge on SPD management overall. Both group students' theoretical test grades were up to standard. The absence of specific graded marks in China, 60 points and above was qualified. Different from this conclusion, previous studies indicated that computer-aided self-instruction or blended learning was an active method of education and could improve knowledge scores (Díaz Agea et al., 2019; Liu et al., 2016). However, in items of application and analysis of SPD management, experimental group students performed better than the control group. The application and analysis process represents the higher cognitive presence, which is consistent with that Col theory devotes to develop critical and higher-order thinking of students (Kim & Gurvitch, 2020). Therefore, Col-based blended learning provided meaningful insight into better improving nursing students' SPD management, even though it did not support total score improvement.

We also found that Col-based blended learning effectively promotes students' practical skills evaluated through the NCEE checklist. Specifically, in addition to the overall skill evaluation improvement, skill performance, management efficiency in the Col-based blended learning group had a better degree of completion than that in the control group. The blended teaching path in this study was based on four phases of inquiry learning cycles of cognitive presence (Kim & Gurvitch, 2020), that is (a) proposing a task/learning objectives (triggering event), (b) self-direct online learning (exploration), (c) brainstorm in a group discussion (integration/

resolution) and (d) team simulation training (application). Thus, results suggest that building Col-based blended learning community was an effective way to promote practical skills in the SPD module.

According to Col theory, for teaching presence it is essential to focus on learning satisfaction and the success of a formal educational community of inquiry (Garrison & Arbaugh, 2007). A previous study quantitatively evaluated students' satisfaction with Col-based blended learning in clinical skill-based module, expressing a moderate level (Siah et al., 2021). In this study, students' comments showed both positive satisfaction and negative satisfaction coexist. Since second-year students did not practice in high-fidelity patient simulation scenarios or working in healthcare fields with the experience of caring for deteriorating patients, they might negatively affect learning satisfaction and performance (Endacott et al., 2015). Besides, students vary in learning demands and adapting this Col-based blended learning, which leads to these two-side comments for satisfaction and gains. Further blended learning design and improvement should focus on students' learning needs and resources, etc.

4.1 | Study limitations

There are several limitations to consider. First, the study did not take random allocation to facilitate overall course arrangements. It is important to add that we compared the baseline of some variables (e.g. prior GPA, gender) for reducing bias. Second, our study was unable to determine the effect of specific components in educational strategies, and this trial was not designed to address this question. The Col-based blended learning community reflects the integration of interventions for learning outcomes. The next step will be to measure and track the multiple components of Col-based blended learning community interventions by a rigorous method, such as specialized Col measurements (Arbaugh et al., 2008). Third, since online resources were available for repeated learning, our research was difficult to estimate the actual time commitment. Fourth, perceived learning gains were self-reported by students. This might cause a self-reported bias because students may tend to report higher learning gains. Students were told that their responses did not affect the teacher's evaluation of students' academic performance, which ensured the quality of answers to some extent.

5 | CONCLUSION

To conclude, promoting learning experience and clinic performance in the SPD programme for undergraduate nursing students will require educational models beyond functional platforms. Col-based blended learning is a multi-component intervention that anchors social, cognitive and teaching presence in an educational setting. Our study findings demonstrate that the Col-based learning community enhanced students' satisfaction and perceived learning gains by promoting purposeful communication, active learning and teamwork.

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CONFLICT OF INTEREST

The authors had no competing interests.

AUTHOR CONTRIBUTIONS

JW and WL: Conception and design, analysis and interpretation of data, article drafting and revising. HZ, CY, SL, CZ and JY: Data collection and literature review; QL and BY: Conception and design, article drafting and revising. Moreover, all authors read and approved the final manuscript.

ETHICAL APPROVAL

The study protocol was approved by the Ethics Committee of Chongqing Medical University.

DATA AVAILABILITY STATEMENT

The data sets generated and analysed during the current study are available from the corresponding author on reasonable request.

ORCID

Jun Wang  <https://orcid.org/0000-0002-7518-7135>

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